

Joint Production, Biodiversity Markets, and PES and Stacking

Purpose

- What are the implications of input joint and input non-joint production upon additionality and defining the relevant baselines with stacking?
- Specifically, compare baseline and additionality of nonjoint and joint production for a primary market when stacking an additional ES in a secondary market under different types of joint production.
- Assume that the benefits to the provider exceed the costs of provision.

Joint Production

- Providing multiple offsets and/or ecosystem services is interrelated through inputs.
- Offsets and ecosystem services cannot be supplied, conserved, or managed in isolation from one another.

Stacking

- If a single project receives payments from multiple programs for multiple services that it generates, those payments are said to be “stacked.”
- Stacking can be thought of as selling different products from a single project, like selling both the wool and the meat from a sheep

Baselines and Additionality

- Baselines are what would have happened in the absence of the intervention, i.e. the counter-factual.
 - In absence of credit/PES market
- Used to define No Net Loss or Net Gain and additionality.
- Baseline chosen impacts size of any additionality.

Additionality

- In a single market, additionality of credits is calculated as the difference between the new, project-induced benefits and the benefits achieved under the specified baseline.

Two Biodiversity/ES Markets

- Consider two ES / offsets and markets A and B.
- Call A primary ES with its own market
- Call B secondary ES with its market created by stacking a second ES/offset from same habitat as A
- Demand is vertical summation for public good
- Prices are for biodiversity offset credits or PES.

Non-joint production...(1)

- Each market and output A & B are effectively independent of one another.
- Prices and quantities are independently formed in each market A & B.
- Supply of A, its price, and its quantity are all unaffected if B enters into a biodiversity/PES market.

Non-joint production...(2)

- Baseline for A is the initial quantity supplied (“current practices”) before entering into the market for A under nonjoint production
- Same for B
- Each stacking project that increases offsets or ES supplied above the baseline satisfies additionality.

Nonjoint Production

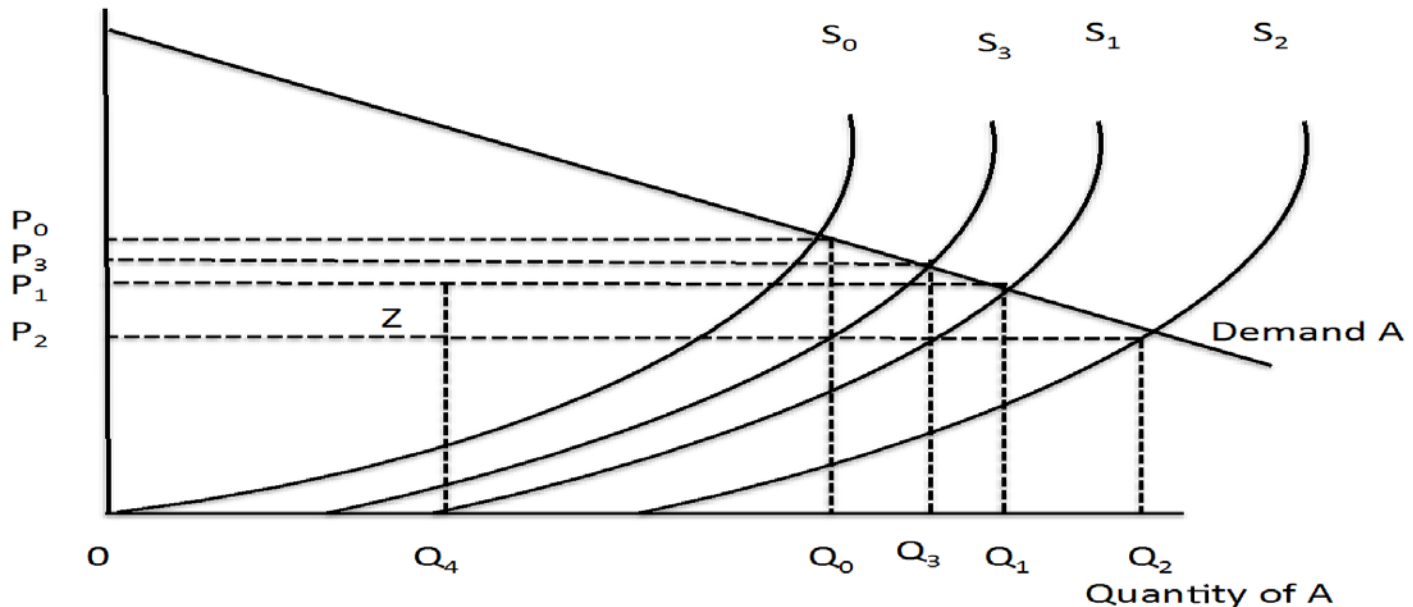
Baseline is initial quantity supplied of A from S_0 without credit market (not shown)

Equilibrium P_0 and Q_0 in credit market

Additionality is $Q_0 -$ initial quantity supplied from S_0

Stacking B does not alter S_0 , initial quantity supplied of A, or P_0, Q_0

Unit price and cost of A



Jointness-in-input prices...(1)

- Output supply is a function entirely of public inputs and not any output or input prices.
- Outputs in fixed proportions.
- Public inputs here = natural capital
- Leads to ecological production function.

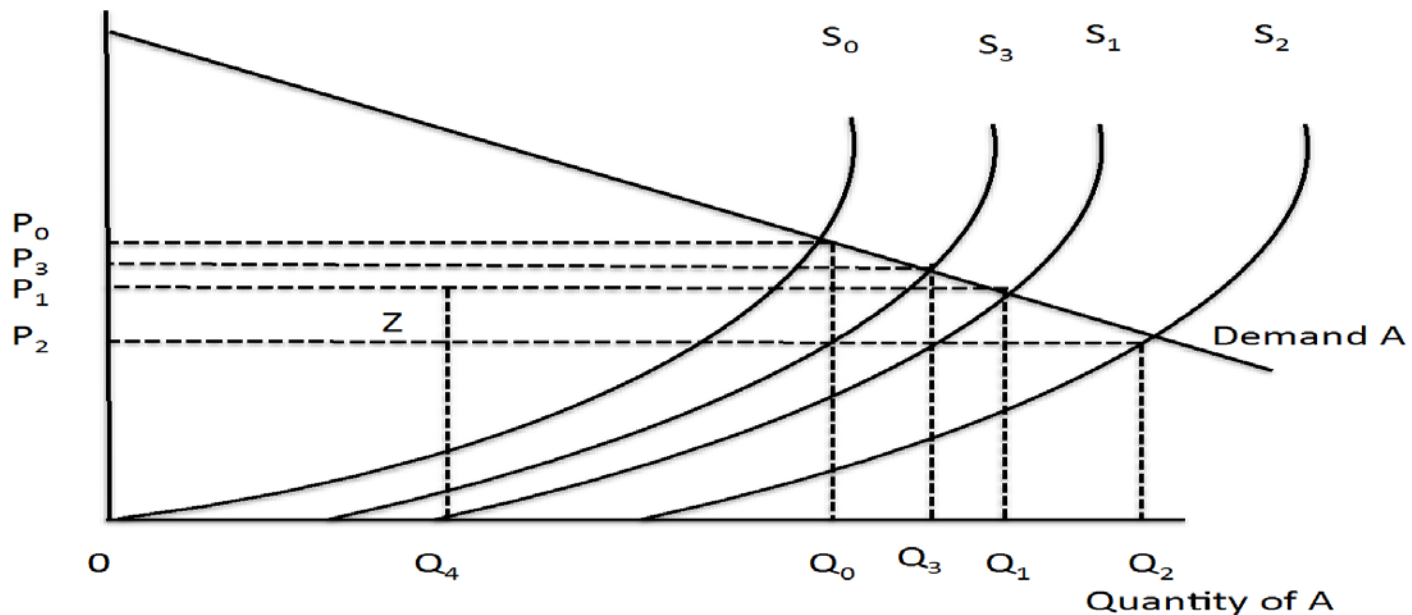
Jointness-in-input prices...(2)

- Increases in own supply (indicated by shifts out or to the right of the supply curve) come only from increases in public inputs.
- Quantity of output supplied (movements along a supply curve) does not respond to changes in own price.
- An equilibrium price and quantity still form in the credit markets.

Jointness-in-input prices...(3)

Baseline for A is S_0 quantity supplied without credit market (not shown).
Initial equilibrium supply of A in credit market is from S_0 with P_0 and Q_0
Additionality is $Q_0 -$ initial quantity supplied from S_0
Stacking B does not alter supply of A or P_0, Q_0

Unit price and cost of A



Jointness-in-input quantities and jointness-in-input quantities and prices...(1)

- ***Joint-in-input quantities:***
- Output supply is a function of all output prices and all prices for private inputs.
- ***Joint-in-input quantities and prices:***
- Output supply is a function of all output prices, all private input prices, and the stocks of all public inputs,

Jointness-in-input quantities and jointness-in-input quantities and prices...(2)

- Leads to lower costs for provision of A than would be found under non-joint production.
- Lower cost of producing A means that the initial supply curve for A now shifts out, from S_0 to S_1 .
- Next consider baseline and additionality with only market for A and no stacking and market for B.

Jointness-in-input quantities and jointness-in-input quantities and prices...(3)

- Initial quantity supplied of A from S_0 (“current practices”) is baseline when calculating additionality by comparing Q_1 to nonjoint production.
 - Two effects: (1) joint to nonjoint (2) credit market
- Initial quantity supplied of A from S_1 (“current practices”) is baseline when calculating additionality by comparing Q_1 under input joint production.

Jointness-in-input quantities and jointness-in-input quantities and prices

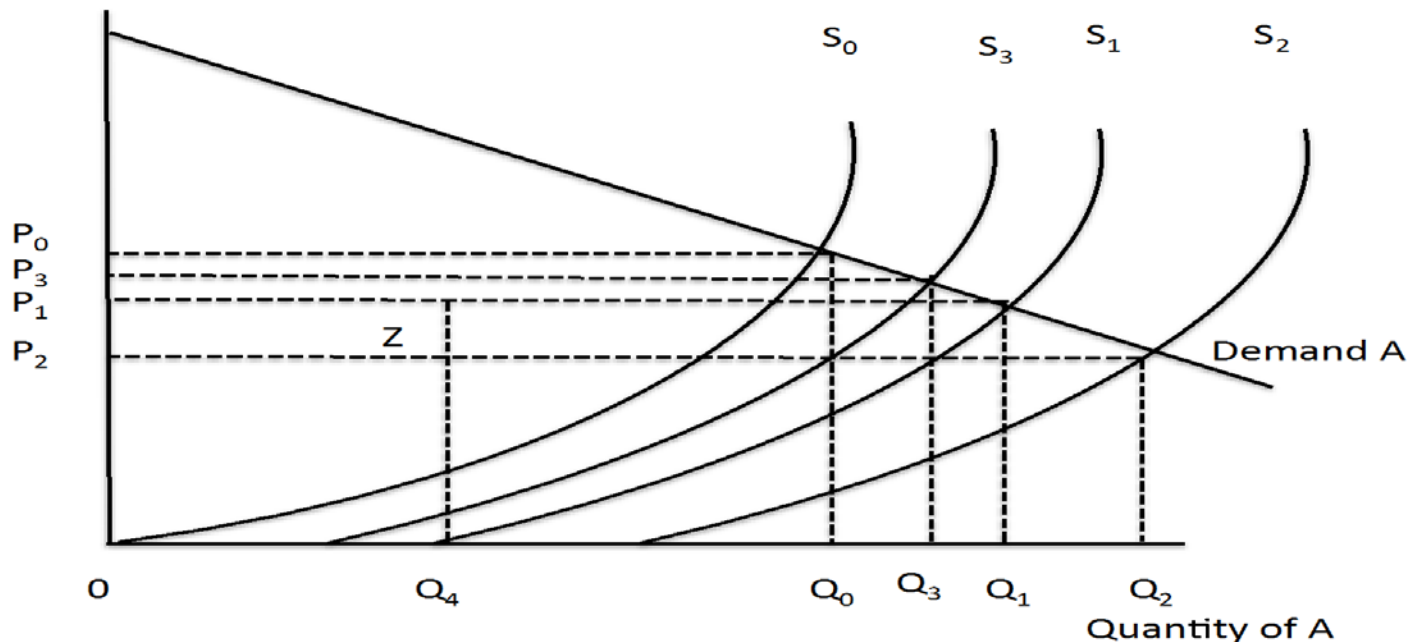
Nonjoint initial quantity supplied of A is baseline is from S_0 with P_0 and Q_0 after credit market for A

Joint initial quantity supplied from S_1 is baseline

With credit market for A, P_1, Q_1

Joint additionality is $Q_1 -$ initial quantity supplied from S_1

Unit price and cost of A



Impact of Introducing Market for B upon Supply of A with Jointness

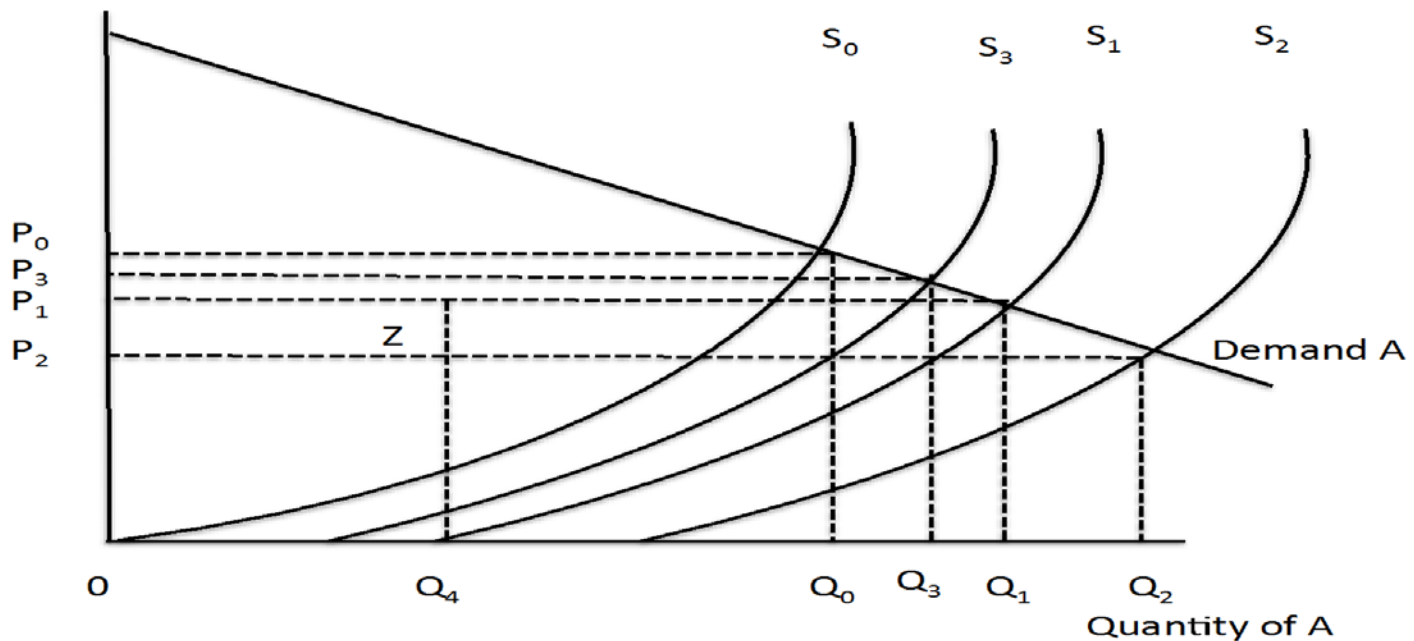
- Hereafter, consider only jointness-in-input quantities and jointness-in-input quantities and prices.
- Market for A is created before market for B due to stacking.
- Now consider impact upon supply of A and baseline from changes in prices when creating a market for B.
 - Introducing B makes price go from 0 to positive.
- Impact upon A's output supply depends upon economic substitute and complementary output supply relationships

Supply of A with Price of B from 0 to Positive: Economic Substitute Outputs

Net effect for A of joint-in-input quantities and joint-in-input quantities and prices is S_2 rather than S_0

After introduction of market for B, P_2, Q_2 rather than P_0, Q_0 .

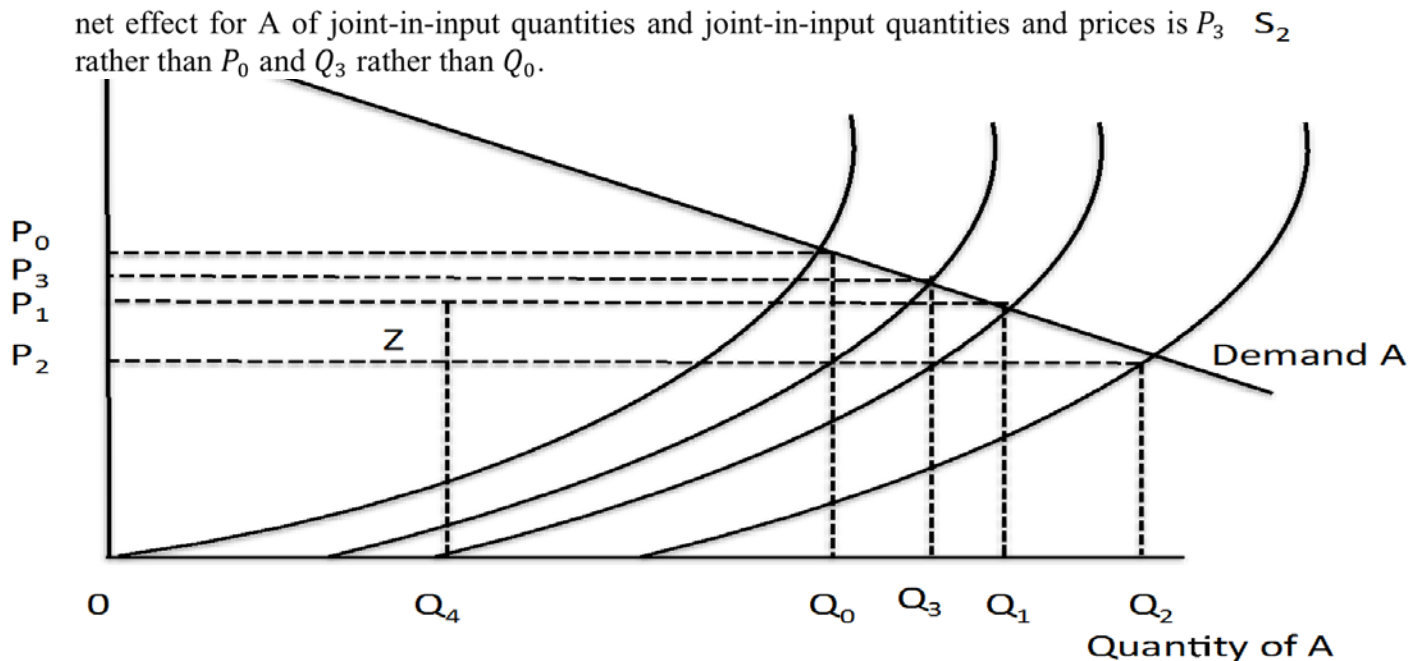
Unit price and cost of A



Supply of A with Price of B from 0 to Positive: Economic Complementary Outputs

Net effect for A of joint-in-input quantities and joint-in-input quantities and prices is S_3 rather than S_0
After introduction of market for B, P_3, Q_3 rather than P_0, Q_0 .

Unit price and cost of A



Baselines with Stacking...(1)

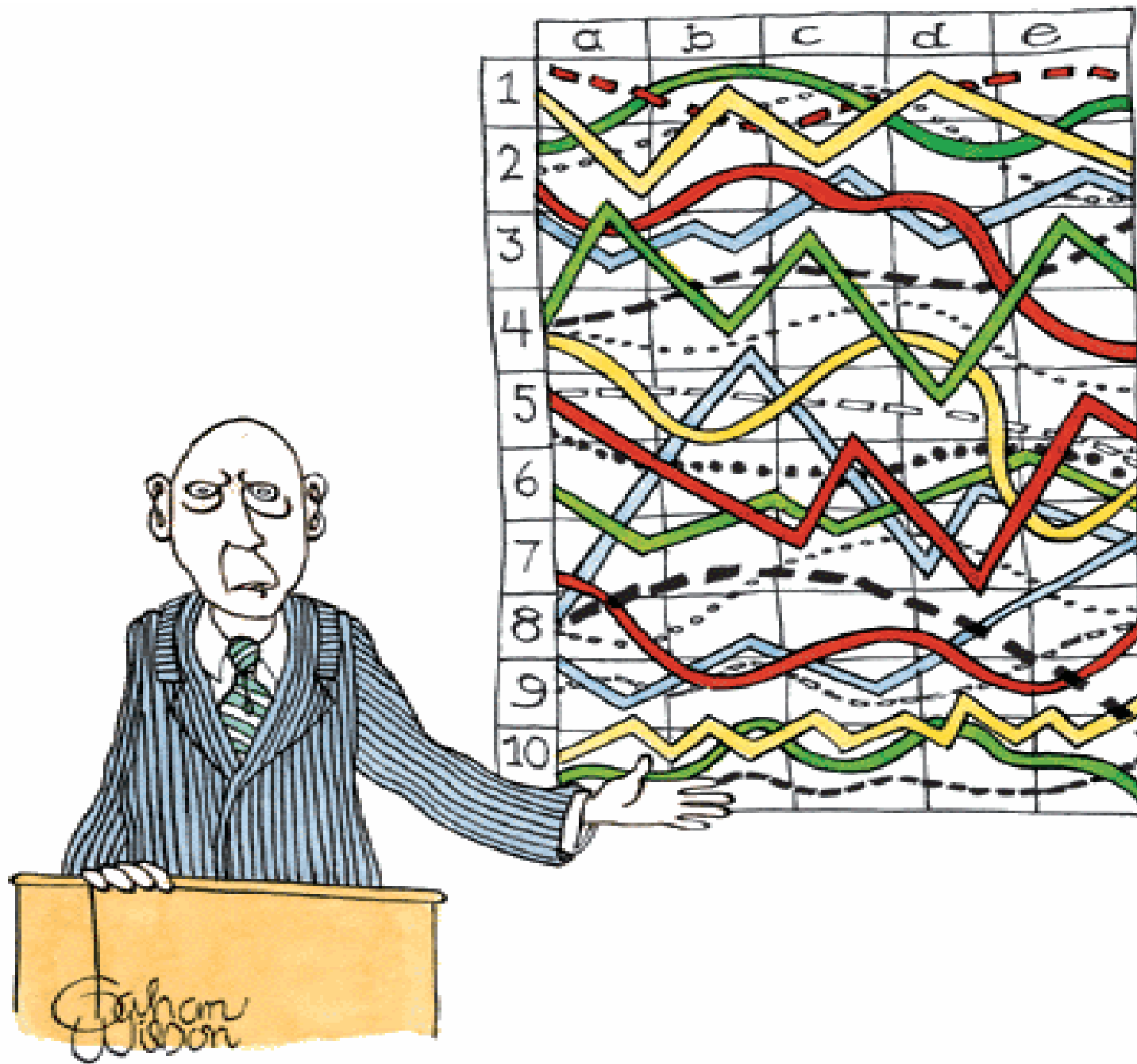
- Baseline for A when stacking B depends upon point of comparison
- Market equilibrium quantity supplied of A depends upon whether there is only a single biodiversity market for A and not a market for B, or equivalently whether the biodiversity market for A is established first.

Baselines with Stacking...(2)

- Baseline for A remains initial quantity supplied from S_0 without credit market when comparing to nonjoint production
- Baseline for A is initial quantity supplied from S_1 without credit market for A when starting with joint production and market for A is established first before market for B.
- Even though stacking of B and creation of credit market for B leads to S_2 or S_3 and P_2, Q_2 or P_3, Q_3 .
- Additionality is Q_1 – initial baseline from S_1 with joint production

Markets for A & B Simultaneously Established

- Under *economic substitution in outputs* for A and B, the supply curve to measure additionality of A is S_2 .
 - Additionality of A measured as the difference between baseline initial quantity supplied from S_2 and Q_2
- Under *economic complementarity in outputs* for A and B, relevant supply curve for A is S_3 with equilibrium P_3, Q_3
 - Additionality of A measured as the difference between the baseline initial quantity supplied from S_3 and Q_3



"I'll pause for a moment so you can let this information sink in."